Old Beer: Looking at the Ability to Produce Ancient Beer for a Modern Audience

An Honors Thesis (HONR 499)

By

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Abstract

Beer production has been around since the agricultural revolution that took place in the Fertile Crescent. Since the craft beer industry is booming in the United States, the time may be right to introduce ancient tastes to modern audiences. The purpose of this paper is to explore the history of beer making through history and to look at the viability of producing authentic ancient beer commercially.

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Introduction

Alcohol has been around for a long time, a very, very long time. Thanks to scientists like Patrick McGovern, a pioneer in the field of Molecular Archaeology and ancient alcohol enthusiast, we know it has been at least 9,000 years and probably more. Found in the Yellow River valley in China, the earliest known fermented beverage was made from wild grapes, hawthorn, rice, and honey (McGovern et al, 2004,). Just think of what that would taste like. Would it be similar to modern mead or maybe a barley wine?

Since there were no recipes or writings about it found at the dig site we will sadly never know what that drink tasted like exactly and that bothers me. Drinking connects us to our predecessors in an intimate way; from the very first alcohol connoisseurs till now drinking has brought people together socially. We should be able to taste what they tasted. Alcoholic beverages like beer and wine were staples in the diets of our ancestors for thousands of years. They were used as payment for work in lieu of gold or silver. They provided nutrients, anti-oxidants, and a source of non-contaminated water. Needing to cultivate more grain for alcohol could have been the reason for why we went from hunter-gatherers to an agricultural society (*How Beer Saved the World, 2011*).

Reading about some of Dr. McGovern's work and watching a fun documentary by the Discovery Channel, aptly named *How Beer Saved the World* inspired me to ask the question:

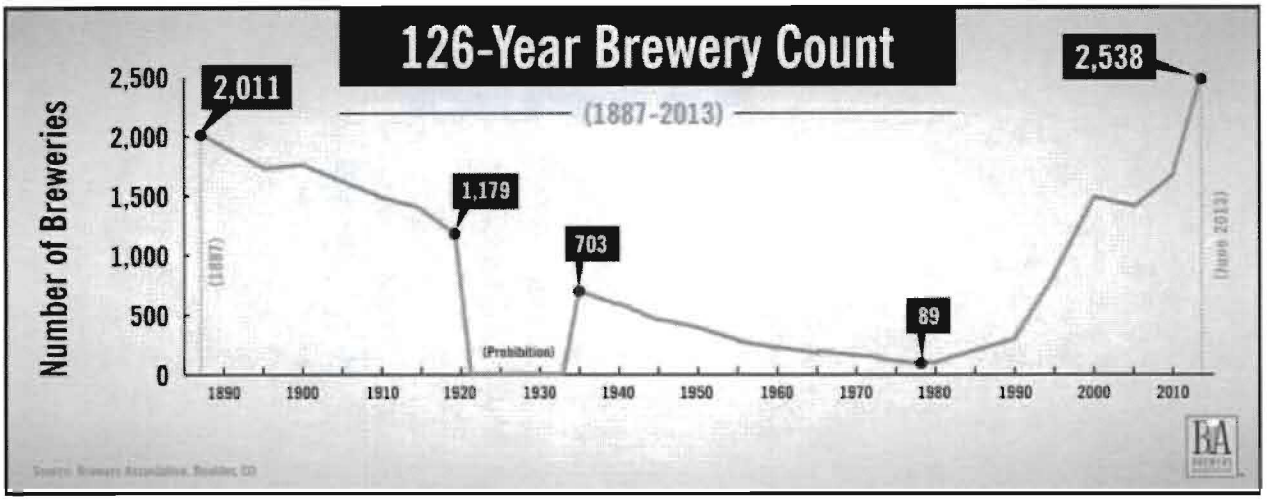
Could a craft beer company be viable if they exclusively reproduced ancient recipes, as close to the original as they could be, with the knowledge at hand?

To answer this question I will look at a few variables: the craft beer industry as a whole, regional preference, the completeness and re-create-ability of ancient beers, and if there is already a similar product, how successful it is. The following sections will be broken down into background information on the industry, information on ancient beers, and conclusions based on my research.

Background Information

Count your lucky stars because we are in the golden age of beer. Never has there been more variety and experimentation in brewing culture. As of 2013, the Brewers Association classified over 130 styles of beer to choose from with more being added every year (Papazian, 2015). Along with the large variety of styles, there is a huge variety of breweries to choose from now as well. The last 50 years has seen the low of brew culture in America to now, where there are a record number of breweries. The following graph (fig. 1) shows the path that breweries have taken.

Fig. 1



Source: http://www.craftbeer.com/the-beverage/history-of-beer/craft-beer-today

This explosion of breweries has opened the door to experimentation. Throughout history certain types of beers were brewed out of convenience, they used the ingredients around them to make the brew, but modern techniques and the ability to combine ingredients from all over the world have created wondrous new aromas and tastes.

The thirst for new has driven the beer industry lately. According to the Demeter Group, while the beer industry as a whole was declining between 2007 and 2011, craft beer was growing. Craft beer is expected to be nearly 15% of the entire market by 2020, a 10% market growth in ten years (Menashe, 2013).

Bitter beers are the rage right now, Untappd.com's (a beer rating social media site) top ten for the United States are all heavily hopped beers, but America's tastes are always evolving. Beer Advocate (another network of beer enthusiasm) has 9 low to no hop beers out of their "top 25 beers added within the last year". This continual change in tastes opens up the door for a creative brewery to introduce new audiences to ancient tastes. Many breweries, like Dogfish

head brewery (creators of the famous ancient to modern brew, Midas Touch), have recreated ancient beers in their lines but usually with modern twists and with modern equipment. However, none that I could find solely focused on bringing ancient beer tastes to modern audiences. This opens up the floor to a business with the right expertise, and location, to possibly be the first successful ancient brewery.

The Beautiful Brews

This section will cover beers that could be made by studying ancient civilizations. Every possible beer will be given a name; a history of the civilization behind the brew will be established, followed by how it was possibly brewed. Then I will explore whether someone has tried to reproduce it, how much liberty they took, and if they were successful.

kaš$_2$ ge$_6$ du$_{10}$-ga (Sweet Dark Beer)– Sumerian Beer

Mesopotamia, located in what is now known as the Middle East, was the setting for arguably the earliest beer production ever recorded. Sumer, the southernmost region of Mesopotamia, was home to Sumerian culture between about 5000 BCE to 1750 BCE. Sumerians have been credited with being one of the earliest civilizations for a number of reasons. They had cities, a written language, and large agricultural innovations (Mark, 2011). *How Beer Saved the World* (2011) postulates that the reason Sumerians were such big innovators is because of their love of beer; they needed more grain for brewing, a way to record information about beer and ingredients, and people to enjoy a brew with. Now that's speculation I can get behind.

Producing a beer taken from a civilization that has been gone for around 4,000 years is about as difficult as it sounds. Not a lot of information has survived. The two main sources of information on what was in the beer and how it was made are excavated clay vats and Sumerian written documents. Things like records about transporting goods to breweries make it a little easier to figure out what could possibly be in it and the "Hymn to Ninkasi", a song to a goddess, gives incite to how Sumerian beer was made (Damerow, 2012). The hymn describes the process of how it was made on the next page.

Given that we don't have a way to directly translate Sumerian Cuneiform into an easy to read text, it takes a lot of interpretation and guesswork to determine what is being said. There seems to be two main ingredients in every type of beer produced by Sumerians, barley...and barley. Barley seems to have been used for both the malt and for flavoring. Sometimes an additional unknown ingredient, possibly emmer wheat, was added to sweeten the beer, making it a "sweet dark beer" (Damerow, 2012). The "Hymn to Ninkasi" praises the goddess Ninkasi, a minor goddess, and gives a description of the brewing process. Some lines from the Hymn are below to give a sense on how it was done.

Ninkasi, you are the one who handles dough (and) ... with a big shovel,
Mixing, in a pit, the bappir with sweet aromatics.
Ninkasi, you are the one who bakes the bappir in the big oven,
Puts in order the piles of hulled grain.
Ninkasi, you are the one who waters the earth-covered malt ("munu"),
The noble dogs guard (it even) from the potentates.
Ninkasi, you are the one who soaks the malt ("sun_2") in a jar,
The waves rise, the waves fall.
Ninkasi, you are the one who spreads the cooked mash ("titab")

on large reed mats,

Coolness overcomes ...

Ninkasi, you are the one who holds with both hands the great sweetwort ("dida"),

Brewing (it) with honey (and) wine.

Ninkasi, [...]

[You ...] the sweetwort ("dida") to the vessel.

The fermenting vat, which makes a pleasant sound,

You place appropriately on (top of) a large collector vat ("laltan").

Ninkasi, you are the one who pours out the fi ltered beer of the collector vat,

It is (like) the onrush of the Tigris and the Euphrates

There have been attempts to recreate a Sumerian beer with varying results. The first that I came across was in 1988 by Anchor Brewing Company. Fritz Maytag, the president, made a small batch to sample at an annual meeting of the American Association of Micro Brewers. It had a 3.5% alcohol concentration, similar to a light beer, and was described as "similar to a hard apple cider" and with a "dry taste lacking in bitterness" (Civil, 1991). The company used modern equipment and techniques, so this is probably not a true representation of what the beer was like (Grossman, 2013). Modern Equipment doesn't aerate the brew like clay does, and ancient beer would have had different strains of bacteria imparting different flavors due to lack of modern sanitization.

Great Lakes Brewing Company, on the other hand, tried a fully authentic brew. Using only clay vats as fermenters and with the guidance of Tate Paulette, a doctoral student at the University of Chicago, they brewed the beer as close as possible to the original way. At first it was too sour to be really palatable, partially due to not having the right ratio of ingredients and partially due to wild bacteria from the lack of modern sanitation (Yaccino, 2013). By a tasting

event it held for the specific purpose of presenting the Sumerian beer, they had dialed in on two palatable versions, one of which was sweetened making it a "sweet dark beer." The unsweetened drink was similar to, but more sour than, a Belgian sour ale. The sweetened was more balanced between sweet and bitter tastes (Trickey, 2015).

If you were to mass produce a beer like this it would be considered somewhat close to Belgium style beers, like a sour ale or a lambic, due to no hops and wild yeast fermentation.

Egyptian Bitcoin - Egyptian Emmer wheat Beer

Contrary to popular belief, Jewish slaves did not build the pyramids. Jewish peoples, or even their forefathers the Hebrews, didn't even exist when these ancient wonders were being built. The laborers were actually a highly skilled workforce that was greatly respected by the rest of the population. They were given choice meats to eat and laborers that died during work were given a proper Egyptian burial (Shaw, 2003).

Though working on the pyramids was still probably obligatory (pre-modern societies had a different take on the role of the individual in society) the workers did get paid. However, they didn't get paid in silver, or gold, or any other kind of precious metal; Egyptian laborers got paid with the elixir of life, beer (*How Beer Saved the World, 2011)*.

How the beer was made to pay the workers is under debate. There are a lot of scenes depicted on Egyptian walls of brewing and drinking but no specific instructions on how it was done. Some of what we do know about Egyptian beer comes from observing the pottery under

a scanning electron microscope (SEM) to study the remaining grains. We know that both barley and emmer wheat was used in the brewing process. We do not know exactly what (or if) anything else was used to flavor the drinks but none has been found in the beers (Samuel, 1996,).

Prior to Delwen Samuel's research in 1996, the leading theory of how the beer was made was a one step process using bread sprinkled into water and letting the malt ferment spontaneously. After Samuel studied remains under the SEM, she found out that not only was the granule in the Egyptian beer not the same as in bread, but there was actually a two-step process, using both heated and unheated grains in the brewing process.

Yeast was probably cultivated and introduced on purpose. The yeast used to make Egyptian beer was *Saccharomyces cerevisia*; a yeast strain commonly found on the surface bloom of grapes, isn't airborne, doesn't live on human skin, and is rare in desert environments. There are two ideas on how ancient brewers introduced it to the malt. One is that they started the yeast in a grape jar and transferred it to the brew. The other is that they skimmed off the frothy yeast on top of the malt and used it to start later fermentations.

As with the Mesopotamian beer, recreations have seen mixed results. From 2001-2004, Sakuji Yoshimura, an Egyptologist, and Kirin Brewery Co., researched and produced two different beers using deciphered wall paintings, authentic ingredients, and pottery. "The Old Kingdom Beer" was a yellow, sour, and wine-like beer made using information dating between 2650 and 2180 BCE. "The New Kingdom Beer" had a light brown color and a bitter-sour taste

with a yogurt-like texture made using information dating between 1570 and 1070 BCE They both had an 8-10% alcohol content. While the Japanese company successfully made the authentic beers, they ran into astronomical costs resulting in a $1,000 per bottle cost, if they wanted to sell the beer commercially (Kachi, 2014).

Barry Kemp, Jim Merrington, and Scottish and Newcastle Breweries actually got their ancient Egyptian beer to market. Tutankhamun Ale had a one-time limited (1000 bottle) release in 1996 after 6 years of development. The brewers used emmer wheat, analyzed water from desert wells, and made beer pots from replica kilns. The ale has a caramel color, with a sweet smell and mouth-coating, and a 6% alcohol content. There is raw grain floating in the finished product. In the words of Jim Merrington, "It's not a connoisseur brew, it's for quaffing." While not considered a connoisseur beer by its brewer, Tutatankhamun Ale has a connoisseur price of $75 a bottle (Vallely, 1996). It is considered one of the top 10 most expensive commercially available beers (Said, 2013).

Skål to the Ancestor – Sahti

The Vikings were a loosely grouped people of the Scandinavian region of Europe. They were farmers, explorers, raiders, and most importantly, drinkers. The age of the Viking is considered to have started in the 8th century CE and lasted until the 11th century ("Norse Lands in the Viking Age"). *Sahti* was (and still is) an important drink to the people of Scandinavia.

Like the Sumerians, Norsemen liked to sing about making beer. The *Kalevala* is Finland's national epic poem pieced together by Elias Lönnrot in the late 19th century from traditional

stories told by storytellers (Asplund and Mettomäki). It has 400 lines dedicated to the invention of beer (Ovell, 1996,).

Scandinavian historical beer is easier to discern how to make than the first two presented because it is still being made in the traditional way to this day. The ingredients are barley, rye, and juniper. The barley and rye are steeped in a lake or stream and then roasted in a malt sauna, sometimes with juniper, to make the malt. The malt is mashed in several stages into increasingly warmer water. Once the malt sugars are infused into the water, the whole mixture is brought to boil, sometimes with hot stones dropped into the mix (Ovell, 1996,).

The next step is crucial to making the *sahti*. The wort is filtered before fermentation through a trough that has been cleaned with boiled juniper water and that is lined with juniper twigs and branches. This infuses *sahti* with unique characteristics. Fermentation of the brew is done by adding yeast (historically taken from pig spit) that has been started in a small sample of wort. The yeast is then recycled for the next batch by skimming it off the top. When the yeast is added a small amount of hops or hops boiled water is also added. After initial fermentation the *sahti* is strained and transferred to a cool location for a secondary fermentation in cool place (Ovell, 1996,).

Since the *sahti* is still made today it is easy to come across. Searching *sahti* on Untappd.com leads to 160 results. Beeradvocate.com states that *sahti* is a cloudy beer and that the juniper leaves a resiny character and that it has a slight tartness. This beer is traditionally in the 7-11% alcohol content range.

Maize Chaw – Chicha de jora

Like the Norsemen from Scandinavia, the native people of the Andes Mountains in South America (like the Incas) have a brewing tradition passed down from their ancestors. *Chicha de jora*, a beer usually made from maize, is that traditional drink. This beer was important to pre-Spanish South America for a few reasons.

Chicha de jora was an important aspect of everyday life to the Incas. It was both a daily beverage and a drink used in ritual and social settings. *Chicha de jora* was also used in "reciprocal hospitality," an idea where labor groups were rewarded with food and drink for working on public projects for the "curaca" or lord (Moore, 1989).

Not only is the ingredient for *chicha de jora* unique compared to the other ancient beers being explored in this paper (maize wasn't introduced into Europe and Asia until almost the 16th century (Janick and Caneva, 2005,)), but the process of making it can also be considered unique. The basic method of brewing *Chicha de jora* is broken into 3 steps: preparing maize, boiling the maize in water, and fermentation (Moore, 1989).

In preparing the maize you can do one of two things. The first is malting the grain the usual way, by soaking it in water to allow it to start germination. The second way is where the uniqueness of *Chicha de jora* comes into play. Instead of germinating the grain to introduce sugar for the yeast to eat, the brewer will chew the corn to introduce their saliva, and let enzymes in the saliva break down the starches into sugar to create the malt (Moore, 1989).

The second and third steps are back on more customary lines. The malt is heated for an extended period of time (fluctuating from 12 hours to a couple days depending on who made it) using hearths. After heating the malt, it is strained through a basketry sieve or a cloth (Moore, 1989).

If you're traveling in South America along the Andes Mountains, you can easily find *Chicha de jora* on the street corners ("Chicha"). However, it is slightly harder to get ahold of in the United States. The only large brewery that I found that makes *chicha de jora* the traditional way is Dogfish Head Brewery. Sam Calagione, the founder of Dogfish Head, Dr. McGovern, and Dr. Clark Erickson, a professor of anthropology, worked together to create it. They imported the correct type of maize and even chewed it themselves to create it (Wadler, 2009). According to Dogfish Head's website, their Chicha has a 5.7% alcohol content.

Conclusions

Based on the research gathered, could a craft beer company be viable if they exclusively reproduced ancient recipes, as close to the original as they could be, with the knowledge at hand? The short answer is, maybe, but probably not. There are two main reasons that I think that this wouldn't work: scalability and spoilage.

The scalability of the recipes needed to make the beers is an obvious problem when looking at them. As the size of the batch of most of the recipes increases, the cost would increase exponentially. The Sumerian, Egyptian and Andean beers need multiple large clay vats to ferment. Compared to modern brewing, which uses large metal chambers; clay vats won't

last as long and can't be made as large as metal vats can be. This means that to make the same amount of beer in clay versus metal, you need more vats to brew in and extra vats for when they break, which means more floor space is needed.

Chicha de jora also has other scalability issues. It took Dogfish Head Brewery a full evening and four people to chew just 7 out of the 20 pounds of maize for a 5 barrel batch of Chicha. According to Calagione, the owner of Dogfish Head, to make a production run in their smallest tank, they would need to chew 800 pounds because the smallest tank makes 200 barrels (Wadler, 2009). Let's make the assumption that 4 people can make 10 pounds of maize chew in 10 hours; that's .25 pounds per man hour (.25lb/hr). If you need 800 pounds of maize that's 3200 man hours (800/.25). If every chewer made the federal minimum wage of $7.25/hour it would cost an extra $23,200 ($7.25*3200) just to prepare the maize for a small 200 barrel production run. To get similar processing of the starches into sugars, you could buy bulk enzymes instead of relying on the enzymes in your spit. You could also crush the corn with milling machinery instead of chewing it. This would make the process quicker, but I don't think the malt would be quite the same consistency as the traditional chew process, making it less authentic.

Along with the scalability issues present in trying to do production runs of ancient beers there is the issue of spoilage. When looking at the ancient recipes something very familiar to modern brewers is missing. Hops, a bittering agent, aren't generally present in any of the ancient beers. It wasn't because of tastes either. Hops didn't start becoming commonplace in brewing until the middle ages; they started being commercially grown in Europe and spread

from there. Hops aren't only there for flavors and aroma though. They also serve as a preservative to prevent spoilage. Hops have bitter acids (α-acids) that act as anti-bacterial agents, inhibiting the main beer contaminant (*Lactobacillus*), other bacteria, and some fungi, while not affecting the yeast (Cleemput et al, 2009).

Since hops and other modern preservatives are absent from the beers, the drinks would spoil extremely quickly. The beers were meant to be drunk quickly after being made (Moore 688; Ovell 12). Modern beer brewing isn't set up to get the entirety of the production run to the end consumers and drunk within days of being made. If you added preservatives, like hops, into the brew, it would change the taste to a point where it's not the same beer anymore. When Joyce Wadler, from the New York Times, gave Dogfish Head's Chicha to native Andeans to try they were not impressed. They said, "This is not chicha" and "It's supposed to be sweeter."

Based on those two things alone, it would be too expensive to make authentic brews in large enough quantities to sell commercially. That doesn't mean anyone who wants to drink what our ancestors drank will be out of luck. Commercial breweries (like Dogfish Head mentioned earlier), while they don't focus only on making authentic beer, do make them for research purposes and use what they learn to influence their modern brews. Plus, there is nothing stopping a home brewer from making small batches. The scalability issues aren't a problem if there isn't scaling. So if you want to taste what our ancestors tasted and drink what they drank, make it yourself. *Skål!*

Works Cited

Asplund, Anneli, and Sirkka-Liisa Mettomäki. "Kalevala: The Finnish National Epic." *ThisisFINLAND*. Finland Promotion Board, Oct. 2000. Web. 30 Mar. 2015.

"Chicha – Peru's Saliva Fermented Corn Beer – Things to Do in Peru." *Escape Traveler*. Escape Traveler, n.d. Web. 06 Apr. 2015.

Civil, Miguel. "Modern Brewers Recreate Ancient Beer." *The Oriental Institute* 132 (Autumn 1991): 1-2. *Uchicago*. The Oriental Institute of the University of Chicago. Web. 20 Mar. 2015.

Cleemput, Marjan Van, Ko Cattoor, Karolien De Bosscher, Guy Haegeman, Denis De Keukeleire, and Arne Heyerick. "Hop ()-Derived Bitter Acids as Multipotent Bioactive Compounds." Journal of Natural Products 72.6 (2009): 1220-230. ACS Publications. Web. 20 Apr. 2015.

Damerow, Peter. *Sumerian Beer: The Origins of Brewing Technology in Ancient Mesopotamia*. Publication. Cuneiform Digital Library Initiative, 22 Jan. 2012. Web. 29 Mar. 2015.

Grossman, Ron. "Craft Brewing, B.C. Style." *Chicago Tribune*. Tribune Publishing, 5 July 2013. Web. 20 Mar. 20.

Ives, Martyn. *How Beer Saved the World*. Discovery Channel. DISC, 30 Jan. 2011. *Netflix.com*. Web. 11 Jan. 2015.

Janick, J., and G. Caneva. "The First Images of Maize in Europe." *Maydica* 550 (2005): 71-80. *Maydica*. Maydica. Web. 3 Apr. 2015.

Kachi, Hiroyuki. "Kirin's New Thirst for Ancient Beer." *Wall Street Journal*. Dow Jones & Company, 14 Oct. 2004. Web. 30 Mar. 2015.

"Modern Craft Beer." *CraftBeer*. Brewers Association, n.d. Web. 30 Mar. 2015.

Mark, Joshua. "Sumer." *Ancient*. Ancient History Encyclopedia, 28 Apr. 2011. Web. 03 Apr. 2015.

McGovern, J. Zhang, J. Tang, Z. Zhang, G. R. Hall, R. A. Moreau, A. Nuñez, E. D. Butrym, M. P. Richards, C.-s. Wang, G. Cheng, Z. Zhao, and C. Wang. 2004. Fermented Beverages of Pre- and Proto-Historic China. Proceedings of the National Academy of Sciences USA 101.51: 17593-9.

Menashe, Jeff. "State of the Craft Beer Industry." *Demetergroup*. Demeter Group Investment Bank, 2013. Web. 30 Mar. 2015.

Moore, Jerry. "Pre-Hispanic Beer in Coastal Peru: Technology and Social Context of Prehistoric Production." *American Antrhopologist* ns 91.3 (1989): 682-95. *JSTOR*. Web. 3 Apr. 2015.

"Norse Lands in the Viking Age." *Hurstwic*. Hurstwic, n.d. Web. 30 Mar. 2015.

Ovell, Peter. *Finland's Indigenous Beer Culture*. Publication no. 1. Helsinki: Perinteisen Oluen Seura, 1996. *POS Beer*. FINNISH SOCIETY FOR TRADITIONAL BEERS. Web. 1 Apr. 2015.

Papazian, Charlie. "Brewers Association 2013 Beer Style Guidelines." *Brewersassociation.com*. Brewers Association, 28 Feb. 2015. Web. 30 Mar. 2015.

Said, Sammy. "The 10 Most Expensive Beers in the World." *The Richest*. N.p., 25 June 2013. Web. 30 Mar. 2015.

Samuel, Delwen. "Investigation of Ancient Egyptian Baking and Brewing Methods by Correlative Microscopy." Science 273.5274 (1996): 488-90. JSTOR. Web. 5 Apr. 2015.

Shaw, Jonathan. "Who Built the Pyramids?" *Harvard Magazine* July-Aug. 2003: 42+. *Harvard Magazine*. Harvard Magazine Inc. Web. 3 Apr. 2015.

"Top Rated Beers." *Untappd*. Untappd, n.d. Web. 30 Mar. 2015.

Trickey, Erick. "Extreme Beer-drinkers Quaff 5,000-year-old Sumerian Brew." Web log post. *Cleveland Magazine Blogspot*. Cleveland Magazine, 15 Aug. 2015. Web. 22 Mar. 2015.

Vallely, Paul. "Reaching the Past Other Lagers Can't Reach." *The Independent* [London] 3 July 1996: n. pag. *The Independent*. The Independent. Web. 30 Mar. 2015.

Wadler, Joyce. "Chew It Up, Spit It Out, Then Brew. Cheers!" *The New York Times*. The New York Times, 08 Sept. 2009. Web. 6 Apr. 2015.

Yaccino, Steven. "For Its Latest Beer, a Craft Brewer Chooses an Unlikely Pairing: Archaeology." *The New York Times*. The New York Times, 17 June 2013. Web. 03 Apr. 2015.